

Sacramento blackfish, although Sacramento squawfish and Sacramento sucker and other species may be present. California roach streams are small, clear, mid-elevation second, third, or fourth order streams that typically contain deep pools in canyons and are often intermittent in flow by late summer. The dominant species is California roach but juveniles of Sacramento squawfish and Sacramento sucker may be present.

## ARTIFICIAL HABITATS

Artificial habitats include ephemeral water, permanent waters and flowing waters. Given the high development within the Central Valley and the development of water resources, it is not surprising that artificial habitats provide a significant amount of habitat.

Ephemeral water include rice paddies, wildlife refuges, drainage and evaporation ponds, and seasonally irrigated lands. Permanent waters include cold water ponds, warm water ponds, ornamental ponds, cold water reservoirs, cool water stratified reservoirs, warm water reservoirs, run-of-river reservoirs, forebays, and flooded pit lakes such as gravel and rock quarries. Flowing waters include aqueducts, drainage ditches, irrigations ditches, and flood control canals and bypasses such as the Yolo Bypass.



### VISION

The vision for freshwater fish habitats is to protect existing habitat from degradation or loss, to restore degraded habitats, and restore areas to a more natural state to assist in the recovery of special-status plant, fish, and wildlife populations.

## LINK TO MSCS EVALUATED SPECIES

The MSCS has identified the following species as potentially benefitting from the restoration freshwater fish habitat in the Bay-Delta system:

### MSCS SPECIES INCLUDED IN THE ERP

- California red-legged frog
- Central Valley steelhead
- winter-run chinook salmon
- bank swallow

- Sacramento splittail
- Central Valley fall-run chinook salmon
- Central Valley spring-run chinook salmon
- western pond turtle
- foothill yellow-legged frog
- western pond turtle
- hardhead
- Sacramento perch
- green sturgeon, and
- eel-grass pondweed.

### OTHER SPECIES EVALUATED IN THE MSCS

- bald eagle
- Central Coast steelhead
- rough sculpin
- black tern, and
- osprey.

## INTEGRATION WITH OTHER RESTORATION PROGRAMS

Efforts to restore freshwater fish habitat would involve cooperation with other restoration and management programs. These include:

- Central Valley Project Improvement Act including the Anadromous Fish Restoration Program,
- Department of Water Resources programs to provide water supplies (State Water Project), flood protection facilities, water quality monitoring, and multipurpose management of California water resources,
- U.S. Army Corps of Engineers flood control operations of reservoirs and management of flood control facilities (e.g., levees, overflow channels and bypass weirs),
- U.S. Bureau of Reclamation operation of the federal Central Valley Project to provide for multiple beneficial uses of water including fish and wildlife protection and habitat restoration,
- U.S. Fish and Wildlife Service and National Marine Fisheries Service programs to recommend flows and other measures needed for mitigating impacts from federal projects and protecting endangered species,
- Other independent water projects in the Central Valley to provide for multiple beneficial uses of

water including fish and wildlife protection and habitat restoration (e.g., Yuba County Water Agency, East Bay Municipal Utilities District, Pacific Gas and Electric Company),

- California Department of Fish and Game responsibility to study and recommend streamflows and temperature requirement for fish protection and propagation in streams,
- FERC regulations of minimum flow below hydropower projects, and
- State Water Resources Control Board administration of water rights for diversion and storage including decisions regarding instream flows for fish, water quality, and public trust resource protection.

## LINKAGE WITH OTHER ECOSYSTEM ELEMENTS

Freshwater fish habitats are linked to other ecological elements in the Bay-Delta watershed. These important habitats are linked to our visions for:

- Central Valley streamflows,
- Central Valley stream temperatures,
- natural sediment supply,
- stream meander,
- natural floodplain and flood processes,
- Delta sloughs,
- riparian and riverine aquatic habitat,
- water diversions,
- dams, reservoirs, weirs, and other structures,
- levees, bridges, and bank protection,
- dredging and sediment disposal,
- gravel mining,
- invasive species,
- predation and competition, and
- fish and wildlife harvest.

## OBJECTIVE, TARGETS ACTIONS, AND MEASURES



The Strategic Objective is to restore large expanses of all major aquatic, wetland, and riparian habitats, and sufficient connectivity among habitats, in the Central Valley and its rivers to support recovery and restoration of native species and biotic communities and rehabilitation of ecological processes.

**LONG-TERM OBJECTIVE:** Restore, protect and manage, on a self-sustaining basis throughout the watershed, multiple large areas containing all aquatic, wetland, and riparian habitat types in the Central Valley and its rivers to a substantial fraction of their pre-settlement areas or to a point where all at-risk species that depend on the habitats are no longer at risk.

**SHORT-TERM OBJECTIVES:** Systematically identify and locate the best remaining areas containing the aquatic, wetland, and riparian habitat types, and prioritize them for conservation. Develop and begin implementation of action plans for restoring significant examples of each habitat type.

**RATIONALE:** Moyle and Ellison (1991) and Moyle (1996) developed a scheme for classifying the aquatic habitats of California for the purposes of conservation. Other classification schemes of aquatic habitats also exist, as do schemes for classifying riparian and wetland habitats. Whatever the system, it is obvious that the diversity of aquatic habitats is declining in Central Valley watersheds, especially in lowland areas. Each habitat supports a different assemblage of organisms, and quite likely many of the invertebrates and plants are still unrecognized as endemic forms. Thus, systematic protection of examples of the entire array of habitats in the region provides some assurances that rare and unusual aquatic organisms will also be protected, preventing contentious endangered species listings.

**STAGE 1 EXPECTATIONS:** A classification system for riverine and riparian habitats that can be used as a basis for conservation actions will have been developed. Inventory of habitat types should be

completed and areas prioritized for conservation actions. Restoration actions should be evaluated and initiated where feasible.

## RESTORATION ACTIONS

The general targets for freshwater fish habitat are:

- protect and rehabilitate floodplain pools, sloughs, backwaters and oxbow lakes,
- improve the quality and extent of flowing water habitats,
- establish and protect a variety of functional habitats for biodiversity, scientific research (e.g., for resident trout streams, salmon-steelhead streams, etc),
- improve the quality of artificial habitats in the Central Valley to better support native fish species.

## MSCS CONSERVATION MEASURES

The following conservation measures were included in the Multi-Species Conservation Strategy (2000) to provide additional detail to ERP actions to enhance or restore freshwater fish habitats that would help achieve species habitat or population targets.

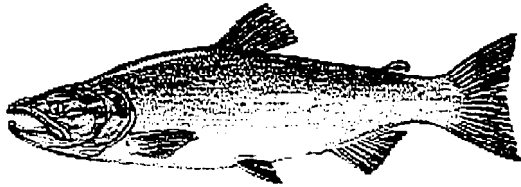
- Implement management measures identified in the proposed recovery plan for the Sacramento River winter-run chinook salmon.
- Coordinate protection and restoration of freshwater fish habitats with other federal and state programs (e.g., U.S. Fish and Wildlife Service recovery plans, the SB 1086 program, and the Corps' Sacramento and San Joaquin Basin Comprehensive Study) that could affect management of occupied and historic habitat use areas to avoid potential conflicts among management objectives and identify opportunities for achieving multiple management objectives.
- Implement applicable management measures identified in the restoration plan for the Anadromous Fish Restoration Program and the recovery plan for the native fishes of the Sacramento/San Joaquin Delta.

- To the extent consistent with CALFED objectives, manage operations of the Red Bluff diversion dam to improve fish passage, reduce the level of predation of juvenile fish, and increase fish survival.
- To the extent consistent with CALFED objectives, manage export flows from the San Joaquin River to improve conditions for upstream migration of adult fish (i.e., attraction flows).
- To the extent consistent with CALFED objectives, operate physical barriers in the Delta in a manner to assist in achieving recovery goals for listed fish species.

## REFERENCES

- Moyle, P.B. 1976. *Inland Fishes of California*. University of California Press, Berkeley, California. 405 pp.
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- Multi-Species Conservation Strategy. 2000. CALFED Bay-Delta Program, Programmatic EIS/EIR Technical Appendix. July 2000.
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# ◆ ESSENTIAL FISH HABITATS



## INTRODUCTION

Essential Fish Habitat (EFH) is the aquatic habitat necessary to allow for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem. The salmon fishery EFH includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon. In the estuarine and marine areas, salmon EFH extends from the nearshore and tidal submerged environments to 60 km offshore. Salmon EFH excludes areas upstream of longstanding naturally impassible barriers (i.e., natural waterfalls in existence for several hundred years) (National Marine Fisheries Service 1998a).

The designation of these habitats is important to allow the systematic protection of biological diversity within distinct geographic regions. The application of such a conservation-oriented classification system is of particular importance in the Central Valley where a rapidly growing human population and large tracts of irrigated agriculture compete with aquatic organisms for water (Moyle and Ellison 1991).

## RESOURCE DESCRIPTION

Public Law 104-267, the Sustainable Fisheries Act of 1996, amended the Magnuson-Stevens Fishery Conservation and Management Act to establish new requirements for "Essential Fish Habitat" description in federal Fishery Management Plans (FMPs) and to require federal agencies to consult with the National Marine Fisheries Service on activities that may adversely affect EFH. The amended act requires the National Marine Fisheries Service to assist the Pacific Fisheries Management Council in the description and identification of EFH for each managed fishery and to provide the Pacific Fishery Management Council with proposed recommendations for EFH (National Marine Fisheries Service 1998a).

## ESSENTIAL HABITATS FEATURES

Habitat and biological associations examined in the development of proposed EFH included:

- Eggs and spawning requirements
- Larvae and alevins requirements
- Juveniles in freshwater
- Juveniles in estuarine waters
- Juveniles in marine waters, and
- Adults requirements.

The National Marine Fisheries Service will assume a holistic approach toward implementation of EFH, and prefers not to subdivide by life stage or habitat type. The intent is to provide habitat conditions that support all life-cycle stages of chinook salmon: an approach fundamentally consistent with the ERP's emphasis on ecosystem management.

In summary, EFH is an integration of two major subdivisions: freshwater essential habitat and marine essential habitat.

Important features of essential habitat for spawning, rearing and migration include adequate: (1) substrate composition; (2) freshwater water quality (e.g., dissolved oxygen, nutrients, temperature); (3) freshwater water quantity, depth and velocity; (4) channel gradient and stability; (5) food; (6) freshwater cover and habitat complexity (e.g., large woody debris, pools, channel complexity, aquatic vegetation); (7) space, (8) access and passage; (9) floodplain and habitat connectivity; (10) adequate marine water quality; (11) adequate marine water temperature; (12) adequate marine prey species and forage base; and (13) adequate depth, cover, marine vegetation, and algae in estuarine and near-shore habitats.



## VISION

The vision for essential fish habitats is to maintain and improve the quality of existing habitats and to restore former habitats in order to support self-sustaining populations of chinook salmon.

## INTEGRATION WITH OTHER RESTORATION PROGRAMS

Efforts to restore freshwater fish habitat would involve cooperation with other restoration and management programs. These include:

- Central Valley Project Improvement Act including the Anadromous Fish Restoration Program,
- Department of Water Resources programs to provide water supplies (State Water Project), flood protection facilities, water quality monitoring, and multipurpose management of California water resources,
- U.S. Army Corps of Engineers flood control operations of reservoirs and management of flood control facilities (e.g., levees, overflow channels and bypass weirs),
- U.S. Bureau of Reclamation operation of the federal Central Valley Project to provide for multiple beneficial uses of water including fish and wildlife protection and habitat restoration,
- U.S. Fish and Wildlife Service and National Marine Fisheries Service programs to recommend flows and other measures needed for mitigating impacts from federal projects and protecting endangered species,
- Other independent water projects in the Central Valley to provide for multiple beneficial uses of water including fish and wildlife protection and habitat restoration (e.g., Yuba County Water Agency, East Bay Municipal Utilities District, Pacific Gas and Electric Company),
- California Department of Fish and Game responsibility to study and recommend streamflows and temperature requirement for fish protection and propagation in streams,
- FERC regulations of minimum flow below hydropower projects, and
- State Water Resources Control Board administration of water rights for diversion and storage including decisions regarding instream flows for fish, water quality, and public trust resource protection.

## LINKAGE WITH OTHER ECOSYSTEM ELEMENTS

Essential Fish Habitats are linked to other ecological elements in the Bay-Delta watershed. These important habitats are linked to our visions for:

- Central Valley streamflows,
- Central Valley stream temperatures,
- natural sediment supply,
- stream meander,
- natural floodplain and flood processes,
- Delta sloughs,
- riparian and riverine aquatic habitat,
- water diversions,
- dams, reservoirs, weirs, and other structures,
- levees, bridges, and bank protection,
- dredging and sediment disposal,
- gravel mining, and
- invasive species.

## OBJECTIVE, TARGETS, ACTIONS, AND MEASURES



The Strategic Objective is to restore large expanses of all major aquatic, wetland, and riparian habitats, and sufficient connectivity among habitats, in the Central Valley and its rivers to support recovery and restoration of native species and biotic communities and rehabilitation of ecological processes.

**LONG-TERM OBJECTIVE:** Protect and manage, on a self-sustaining basis throughout the watershed, multiple large areas containing all aquatic, wetland, and riparian habitat types in the Central Valley and its rivers (including the Delta and Suisun and San Francisco Bays) to a point where all at-risk species that depend on the habitats are no longer at risk.

**SHORT-TERM OBJECTIVE:** Systematically identify and locate the best examples of essential fish habitats and prioritize them for conservation. Develop and begin implementation of action plans for restoring significant examples of each habitat type.

**RATIONALE:** Declines in the abundance of chinook salmon have been well-documented throughout the southern portion of their range. Concern over coast wide declines from southeastern Alaska to the Pacific Northwest was a major factor leading to the signing of the Pacific Salmon Treaty between the United States and Canada in 1985. Naturally spawning chinook salmon populations have been extirpated from large portions of their historic range in a number of watersheds in California and all Evolutionarily Significant Units have been proposed for listing by the National Marine Fisheries Service (1998b).

Habitat degradation is the major cause for extinction of populations and many extinctions are related to dam construction and operation. Urbanization, agricultural land use, water diversion, and logging are also factors contributing to habitat degradation and the decline of chinook salmon (Nehlsen 1991). The development of large-scale hatchery programs have, to some degree, mitigated the decline in abundance of chinook in some areas. However, the genetic and ecological interactions of hatchery and wild fish have also been identified as risk factors for wild populations, and high harvest rates directed at hatchery fish may cause over-exploitation of commingled wild stocks (Reisenbichler 1997).

**STAGE 1 EXPECTATIONS:** Inventory of habitat types should be completed and areas prioritized for conservation actions. Restoration actions should be evaluated and initiated where feasible.

## RESTORATION ACTIONS

The general targets for essential fish habitat are:

- protect and rehabilitate habitat required for chinook salmon spawning and egg development,
- improve the quality and extent of flowing water habitats,
- protect and improve habitats required for short-term and long-term juvenile freshwater rearing,
- improve the quality of habitats in the Central Valley to better support adult migration and holding.

## MSCS CONSERVATION MEASURES

The following conservation measures were included in the Multi-Species Conservation Strategy (2000) to provide additional detail to ERP actions to enhance and restore essential fish habitat that would help achieve species habitat or population targets.

- Coordinate protection, enhancement, and restoration of occupied and historic winter-run chinook habitat with other federal, state, and regional programs, (e.g., the San Francisco Bay Area Wetlands Ecosystem Goals Project, the Anadromous Fish Restoration Program, the SB 1086 program, and the Corps' Sacramento and San Joaquin River Basins Comprehensive Study) that could affect management of current and historic habitat use areas to avoid potential conflicts among management objectives and identify opportunities for achieving multiple management objectives.
- Implement management measures identified in the proposed recovery plan for the Sacramento River winter-run chinook salmon.
- To the extent consistent with CALFED objectives, manage operations at the Red Bluff diversion dam to improve fish passage, reduce the level of predation on juvenile fish and increase fish survival.
- Implement applicable management measures identified in the restoration plan for the Anadromous Fish Restoration Program and the recovery plan for the native fishes of the Sacramento/San Joaquin Delta.
- To the extent consistent with program objectives, minimize flow fluctuations to reduce or avoid stranding of juvenile fish.

## REFERENCES

- Moyle, P.B., and J.P. Ellison. 1991. A conservation-oriented classifications system for the inland waters of California. *California Fish and Game* 77(4):161-180.
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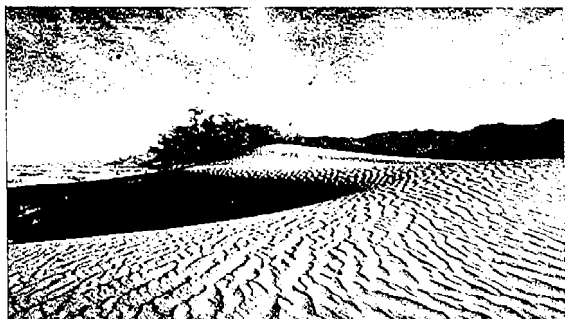
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Strategic Plan for Ecosystem Restoration. 2000. CALFED Bay-Delta Program, Programmatic EIS/EIR Technical Appendix. July 2000.

# ◆ INLAND DUNE SCRUB HABITAT



## INTRODUCTION

Inland dune scrub is associated with inland sand dunes and is limited in the ERPP focus area to the vicinity of the Antioch Dunes National Wildlife Refuge. This habitat area supports two plant and one butterfly species listed as endangered under the federal Endangered Species Act. Major factors that limit this resource's contribution to the health of the Delta are related to adverse effects of sand mining, dune conversion to other land uses, dune stabilization, and land use practices that maintain the dominance of non-native plants.

## RESOURCE DESCRIPTION

Historic dunes within the Sacramento-San Joaquin Delta Ecological Management Zone may have covered 15,560 acres, based on soil surveys, including 8,510 acres of Delhi series, 5,810 acres of Piper series in Contra Costa County, and 1,300 acres of Tinnin series in Sacramento County. The Delhi series was a large area of dunes in the Antioch-Oakley area, of which the Antioch Dunes National Wildlife Refuge is a tiny remnant. The Piper series were small areas of remnant dunes within the organic soils of the Delta marshes, remnants of larger areas of dunes that existed prior to the rise in sea level at the end of the last ice age. The Tinnin series were small isolated dunes on the eastern edge of the Delta.

Remaining habitat areas are being protected. Recent land-use changes help this habitat support several special-status plant and wildlife species. Most protected inland dune scrub is located within the Antioch Dunes National Wildlife Refuge and Brannan Island State Park. Most of the inland dune

scrub habitat outside these two areas are protected to various degrees.

**Inland Dune Scrub Habitat** is defined in the MSCS as habitat comprised of vegetated stabilized sand dunes associated with river and estuarine systems. Inland dune scrub includes all of the ERP inland dune scrub habitat (Multi-Species Conservation Strategy 2000).

Two special-status plant species, the Antioch Dunes evening primrose and the Antioch Dunes wallflower, are found with inland dune scrub. The Lange's metalmark, a butterfly listed as endangered under the federal Endangered Species Act (ESA), is known only from the Antioch Dunes, where it feeds on naked buckwheat. The low nutrient conditions of the soils and natural instability of dune sands limit the amount of vegetation that establishes on the inland dunes. The dunes represent a localized habitat that does not support other types of upland vegetation.

As in other dune ecosystems, such as coastal dunes and desert sand dunes, wind is the major process that shapes dunes and dune structures. The presence of the wind-modified, river-deposited sands, in combination with the Delta wind patterns, maintain a natural disturbance threshold that favors the establishment of the plant species that are characteristic of dunes and prevents the establishment of species less tolerant of these conditions.

Direct and indirect disturbances are reducing the extent and health of inland dune scrub habitat and its associated plants and animals. Sand mining directly removes habitat. Urban development has moved onto historical dune habitat and changed wind-flow patterns. Excessive foot traffic, off road vehicle traffic, and grazing disturb dune surfaces, which makes dunes more susceptible to erosion. Application of herbicides, pesticides, and fertilizers change ecological processes that may encourage or support non-native species. Structures or activities that reduce or accelerate winds, wind-disturbances, or barriers to wind-driven sand movement, disrupt the processes that sustain dunes. Wind patterns blow river-deposited sand into shifting dunes. Shifting



sand offers little stability for establishing plant root systems. Plant species characteristic of dunes survive within a disturbance threshold. Direct disturbances inhibit the ability of dune-associated plants to establish and result in loss of plant vigor or mortality. Sand movement barriers create conditions unfavorable for establishing native dune vegetation. These types of disturbances create site conditions conducive to establishing invasive weedy plants. Non-native weeds compete with native dune plants and reduce overall habitat quality. Continued disturbance of potentially restorable adjacent habitat could interfere with protecting and restoring additional areas of high-quality habitat by affecting dune structure and destroying buckwheat, Antioch evening primrose, and Antioch Dunes wallflower plants.



### VISION

The vision for inland dune scrub habitat is to protect and enhance existing areas and restore former habitat areas. Achieving this vision will provide high-quality habitat for associated special-status plant and animal populations.

Restoration of inland dune scrub would focus on protecting and improving important existing habitat areas. Historic inland dunes adjacent to existing ecological reserves in the Sacramento-San Joaquin Delta Ecological Management Zone would be reestablished. Protecting and restoring inland dune scrub habitat would begin by identifying areas that are not currently managed for their resource values. Appropriate methods to protect and restore identified areas would be developed. Protected habitat areas would be evaluated to determine effective restoration management practices to increase habitat value. The results of these evaluations would determine how habitat would be protected and restored.

### LINK TO MSCS EVALUATED SPECIES

The MSCS had identified the following species as potentially benefitting from the enhancement of inland dune scrub habitat in the Bay-Delta system.

#### MSCS SPECIES INCLUDED IN THE ERP

- Lange's metalmark
- Antioch Dunes evening primrose, and

- Contra Costa wallflower.

#### OTHER SPECIES EVALUATED IN THE MSCS

- San Joaquin whipsnake.

### INTEGRATION WITH OTHER RESTORATION PROGRAMS

Efforts to restore inland dune habitats will involve cooperation with programs managed by the Antioch Dunes National Wildlife Refuge. Cooperation from agencies with responsibility or authority for restoring inland dune habitat will be solicited. These include:

- California Department of Fish and Game,
- U.S. Fish and Wildlife Service,
- U.S. Army Corps of Engineers,
- and the Delta Protection Commission,

### LINKAGE WITH OTHER ECOSYSTEM ELEMENTS

Inland dune scrub habitat is limited to the area near the Antioch Dunes Ecological Reserve, Brannan Island State Park and a few other localities. This type of habitat is important for two plant and one butterfly species listed as endangered under the federal Endangered Species Act.

It is adversely affected by human caused actions that contribute to erosion and spread of non-native species. One important linkage in maintaining this habitat is maintenance of river flows which deposit sediments including sand which feed the dune formation process.

### OBJECTIVE, TARGETS ACTIONS, AND MEASURES



The Strategic Objective is to restore large expanses of all major habitat types, and sufficient connectivity among habitats, in the Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay to support recovery and restoration of native species and biotic communities and rehabilitation of ecological processes.

**LONG-TERM OBJECTIVE:** Restore inland dune scrub habitat in the Delta to a substantial fraction of its presettlement areas, or to a point where all at-risk species that depend on the habitat are no longer at risk.

**SHORT-TERM OBJECTIVE:** Develop and begin implementation of action plans for significant examples of inland dune scrub habitat in the Delta.

**RATIONALE:** All major natural habitat types in the Delta, Suisun Bay, Suisun Marsh, and San Francisco Bay have been reduced to a small fraction of the area they once occupied, resulting in a large number of at-risk plant and animal species and an increased susceptibility of the remaining areas to irreversible degradation (e.g., invasion by non-native species). The reduction trend is continuing and will have to be reversed if self-sustaining examples of these habitats, and the diverse organisms they support, are to persist into the future. This reversal will require a large number of diverse and localized actions, from levee setbacks to land acquisition to better management of existing sites. The major habitat types to be restored include tidal shallow water habitat, freshwater emergent wetland, channel islands and associated habitats, tidal sloughs, nontidal freshwater emergent wetlands, seasonal upland wetlands, vernal pools and surrounding uplands, riparian forests and associated upland areas, perennial grassland, and inland dune scrub. In order to make restoration actions systematic and cost-effective, specific objectives need to be established for each of the habitat types, as well as subsets of them that have distinctive biological characteristics, and then priorities set within each objective for protection and restoration activities.

## RESTORATION ACTIONS

General restoration targets for inland dune scrub habitat are directed at protecting and restoring 50 to 100 acres of low- to moderate-quality Antioch inland dune scrub habitat within or adjacent to existing ecological preserves in the Central and West Delta Ecological Management Unit.

Managing protected areas could include reducing disturbance of dunes and dune vegetation. This could be accomplished by reducing vehicle and pedestrian access to dune areas. Protective structures, such as small boardwalks could be built. These

actions would reduce habitat disturbance while maintaining recreational access. The following actions would help restore inland dunes:

- remove barriers to wind-driven sand-dune movement to increase the area that would be available for natural expansion of the sand-dune base;
- import sands from areas being developed or clean sand dredged from Bay-Delta channels to increase restoration potential and dune area;
- control non-native weeds to recreate conditions suitable to reestablishing native dune plants; and
- reduce the use of herbicides, pesticides, and fertilizers that adversely effect native dune vegetation and animals.

Dune habitat protection and restoration strategies could be implemented through cooperative efforts with existing ecological reserves. Restoration efforts should focus on implementing existing protection and restoration programs, establishing cooperative agreements with land management agencies, and establishing conservation easements or purchasing land from willing sellers.

## MSCS CONSERVATION MEASURES

The following conservation measures were included in the Multi-Species Conservation Strategy (2000) to provide additional detail to ERP actions to enhance and restore inland dune scrub habitat that would help achieve species habitat or population targets.

- Coordinate protection and restoration of inland dune scrub habitats with other programs (e.g., U.S. Fish and Wildlife Service recovery plans and management of the Antioch Dunes Preserve) that could affect management of occupied and historic habitat use areas to avoid potential conflicts among management objectives and identify opportunities for achieving multiple management objectives.
- Conduct surveys to locate potential habitat restoration sites on Tinnin soils and identify opportunities for and implement permanent protection, restoration, and management of these